



Lowell Regional Wastewater  
451 First Street Boulevard  
Lowell, MA 01854  
Attn: Aaron Fox

November 5, 2019

Dear Mr. Fox,

Enclosed please find the toxicological evaluation and chemical analyses report for the effluent sample received on October 7<sup>th</sup>, 2019. This is your fourth quarter 2019 bioassay. Please call me at (401) 353-3420 if you have any questions.

Sincerely,

Michael McCallum  
Technical Laboratory Director

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill St., West Warwick, RI 02893

(401) 353-3420

TOXICOLOGICAL EVALUATION  
AND CHEMICAL ANALYSES  
OF EFFLUENT:  
NPDES Permit # MA0100633  
Fourth Quarter 2019 Samples  
Lowell

Prepared For:  
Lowell Regional Wastewater  
451 First Street Boulevard  
Lowell, MA 01854

November 5, 2019

By  
New England Testing Laboratory, Inc.  
59 Greenhill Street  
West Warwick, RI 02893

NETLAB CASE NUMBER: 9J07023



New England Bioassay

A Division of GZA



## NEW ENGLAND BIOASSAY A DIVISION OF GZA CHRONIC AQUATIC TOXICITY TEST REPORT

Permittee: Lowell RWWU NPDES # MA0100633  
 Report submitted to: New England Testing Laboratories  
59 Greenhill Street, West Warwick RI  
 Sample ID: Effluent  
 Test Month/Year: October 2019  
 NEB Proj # 05.0044476.00

Test Type / Method: *Ceriodaphnia dubia* Modified Chronic Static-Renewal Freshwater  
 Test Method 1002.0; EPA 821-R-02-013

Effluent Sample Dates: #1 10/6-7/19 #2 10/8-9/19 #3 10/10-11/19

Test Start Date: 10/8/19

### Results Summary

Your results were as follows:

Passed all permit limits

### Acute Test Results

Species	LC50	A-NOEC	Permit Limit	Pass / Fail
<i>Ceriodaphnia dubia</i>	>100%	100%	≥ 100%	Pass

### Chronic Test Results

Species	C-NOEC	C-LOEC	IC25	Permit Limit	Pass/Fail
<i>Ceriodaphnia dubia</i>	6.25%	12.5%	26.5%	N/A	N/A

Data Qualifiers affecting this test:

Certifications & Approvals: NH ELAP (2071), NJ DEP (CT405)

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## Test Report Certification

Permittee name: Lowell RWWU Permit number: MA0100633  
Client sample ID: Effluent Test Start Date: 10/8/19

### Whole Effluent Toxicity Test Report Certification (Permittee)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: \_\_\_\_\_  
(Date)

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Print or Type Name and Title

\_\_\_\_\_  
Print or Type the Permittee's Name

MA0100633  
\_\_\_\_\_  
Print or Type the NPDES Permit Number

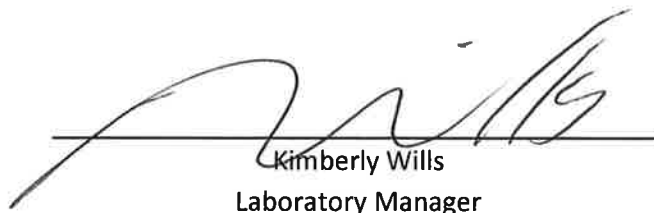
### Whole Effluent Toxicity Test Report Certification (Bioassay Laboratory)

The results reported relate only to the samples submitted as received

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: \_\_\_\_\_

11/4/19  
(Date)

  
\_\_\_\_\_  
Kimberly Wills  
Laboratory Manager

New England Bioassay a division of GZA

## General Test Conditions

Permittee name Lowell RWWU Permit number: MA0100633  
Client sample ID Effluent Test Start Date: 10/8/19

### Sample Collection Information

Effluent #1 Dates/Times: 10/6-7/19 @ 0700-0700 Receiving Water #1 Date/Time: 10/7/19 @ 0830

Effluent #2 Dates/Times: 10/8-9/19 @ 0700-0700 Receiving Water #2 Date/Time: 10/9/19 @ 0800

Effluent #3 Dates/Times: 10/10-11/19 @ 0700-0700 Receiving Water #3 Date/Time: 10/11/19 @ 0748

Were a minimum of three samples collected? Yes ☒ No ☐ \*(see note below)

Were samples used within the first 36 hours of collection? Yes ☒ No ☐ \* (see note below)

\* sample collection note:

### Test Conditions

Permittee's Receiving Water: Merrimack River

- Dilution water: Laboratory synthetic soft water (hardness 45 - 55 mg/L CaCO<sub>3</sub>)
- Control water: Receiving water collected at a point immediately upstream of or away from the discharge

Effluent concentrations tested: 0%, 6.25%, 12.5%, 25%, 50%, 100%

Was effluent salinity adjusted? No ☒ Yes ☐ with Instant Ocean sea salts to \_\_\_\_\_ ppt

Dechlorination procedures: Chlorine is measured using 4500 CL-G DPD Colorimetric Method

- Chlorine was elevated due to interference. Chlorine was  $\leq 0.05$  mg/L by amperometric titration

TRC results and further information about aeration of samples can be found attached in "sample receipt chemistry"

### Reference Toxicant Data

#### *Ceriodaphnia dubia*

Date: 10/1/19  
Toxicant: Sodium chloride  
Dilution Water: NEB CTRMH  
Organism Source: NEB  
Reproduction IC<sub>25</sub>: 1.02 g/L  
Results within range Yes ☒ No ☐

## Ceriodaphnia dubia Test Results

Permittee name: Lowell RWWU Permit number: MA0100633  
 Client sample ID: Effluent Test Dates: 10/8/19 - 10/15/19

### Test Acceptability Criteria

Lab Diluent Survival: 80 % Mean Lab Diluent Reproduction: 21.7 young per female  
 River Control Survival: 90 % Mean River Control Reproduction: 22.7 young per female  
 Thiosulfate Control Survival: N/A % Mean Thiosulfate Control Reproduction: N/A young per female  
 Presence of an asterisk (\*) indicates EPA criteria was not met, see explanation in the "Results Discussion" section at the bottom of the following page.

### Test Results

		Permit Limit	Test Result	Pass/Fail Status
<b>Acute Data</b>	48 hr LC50	≥ 100%	>100%	Pass
	48 hr NOEC		100%	
	TUa			
<b>Chronic Data</b>	Chronic LC50		>100%	
	Survival C-NOEC		100%	
	Survival C-LOEC		>100%	
	Reproduction C-NOEC		6.25%	
	Reproduction C-LOEC		12.5%	
	Reproduction IC25		26.5%	
	Reproduction IC50		56.8%	
	Reportable C-NOEC		6.25%	
	Reportable C-LOEC		12.5%	
	MATC		8.8%	
	TUc			

Presence of an asterisk (\*) indicates qualified data, see explanation in the "Results Discussion" section at the bottom of the following page.

### Test Variability

- Reproduction PMSD: 17.5% Upper & Lower EPA bounds: 13 - 47% ☐ Low ☒ Within bounds ☐ High
- ☐ PMSD exceeds upper bounds. Test results are highly variable and may not be sensitive enough to determine the presence of toxicity at the permit limit concentration (PLC)
- ☒ The PMSD falls within the upper (47%) and lower (13%) bounds. Results are reportable.
- ☐ PMSD falls below the lower bound test variability criterion. The test is very sensitive. The relative percent difference (RPD) between the control and each treatment was calculated and compared to the lower bound.
- ☐ The RPD values for all concentrations fall below the lower bound. Any differences observed in this test are considered statistically insignificant.
- ☐ Some of the concentrations that were flagged as statistically significant have RPD values that fall below the lower bound. Any differences observed in these concentrations will not be considered statistically significantly decreased from the control.
- ☐ No statistically significant reductions were observed in this test.

## ***Ceriodaphnia dubia* Test Results**

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 10/8/19 - 10/15/19

### **Concentration - Response Evaluation**

Survival: #12 No significant effects at any test concentration with a flat concentration-response curve.  
Test concentrations performed very similarly to dilution control.

Reproduction: #1 The concentration - response relationship observed in this data set corresponds to the following item number in Chapter Four of "Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing (40 CFR Part 136)", EPA 821-B-00-004, July 2000: #1 Ideal concentration-response relationship.

The concentration - response relationship was reviewed and the following determination was made:

Survival	Reproduction	
<u>X</u>	<u>X</u>	Results are reliable and reportable
<u>      </u>	<u>      </u>	Results are anomalous (see explanation below)
<u>      </u>	<u>      </u>	Results are inconclusive - retest (see explanation below)

### **Results Discussion (if applicable):**

# TEST METHODS



## ***Ceriodaphnia dubia***

<b>Test type:</b>	Modified Chronic Static Renewal Freshwater Test
<b>Test Reference Manual:</b>	EPA-821-R-02-013 "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms"
<b>Test Method:</b>	<i>Ceriodaphnia dubia</i> Survival and Reproduction Test - EPA 1002.0
<b>Temperature:</b>	25 °C ± 1°C (Temperatures should not deviate by more than 3°C during the test) (required)
<b>Light Quality:</b>	Ambient Laboratory Illumination (recommended)
<b>Light Intensity:</b>	10-20 µE/m <sup>2</sup> /s, or 50-100 ft-c (recommended)
<b>Photoperiod:</b>	16 hours light, 8 hours dark (recommended)
<b>Test chamber size:</b>	30 mL (recommended minimum)
<b>Test solution volume:</b>	15 mL (recommended minimum)
<b>Renewal of Test Solutions:</b>	Daily (required)
<b>Age of Test Organisms:</b>	Less than 24 hours; and all released within a 8-h period (required)
<b>Number of Neonates Per Test Chamber:</b>	1 Assigned using blocking by known parentage (required)
<b>Number of Replicate Test Chambers Per Treatment:</b>	10 (required minimum)
<b>Number of Neonates Per Test Concentration:</b>	10 (required minimum)
<b>Feeding Regime:</b>	Fed 0.1 mL each of YCT and algal suspension per exposure chamber daily. (recommended)
<b>Cleaning:</b>	Use new plastic cups daily (recommended)
<b>Aeration:</b>	None (recommended)
<b>Test Duration:</b>	Until 60% or more of control females have three broods (maximum test duration 8 days) (required)
<b>Endpoints:</b>	Survival and reproduction (required)
<b>Test Acceptability:</b>	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods. (required)
<b>Sampling Requirements:</b>	Minimum of three samples with a maximum holding time of 36 hours before first use. (required)
<b>Sample volume required:</b>	1 L/Day (recommended)

# CERIODAPHNIA DUBIA DATASHEETS & STATISTICAL ANALYSIS

# NEW ENGLAND BIOASSAY TOXICITY DATA FORM

## CHRONIC COVER SHEET

CLIENT: New England Testing Laboratories  
 ADDRESS: 59 Greenhill Street  
West Warwick, RI 02893  
 PERMITTEE: Lowell RWWU  
 PERMIT NUMBER: MA0100633  
 DILUTION WATER: Laboratory Soft Water

*C. dubia* TEST ID # 19-1448  
 CHAIN OF CUSTODY # C39-3714/15  
 NEB PROJECT # 05.0044476.00  
 SAMPLE ID: Effluent

### INVERTEBRATES

TEST SET-UP TECHNICIAN: CW  
 TEST SPECIES: *Ceriodaphnia dubia*  
 NEB LOT # Cd19(RMH 223)  
 AGE: < 24 hours  
 TEST SOLUTION VOLUME (mls): 15  
 ORGANISMS PER TEST CHAMBER: 1  
 ORGANISMS PER CONCENTRATION: 10

### LABORATORY CONTROL WATER (SRCF)

Lot Number	Hardness mg/L CaCO <sub>3</sub>	Alkalinity mg/L CaCO <sub>3</sub>
C39-S024	48	30

	DATE	TIME
TEST START:	10/8/19	1355
TEST END:	10/15/19	1448

COMMENTS:

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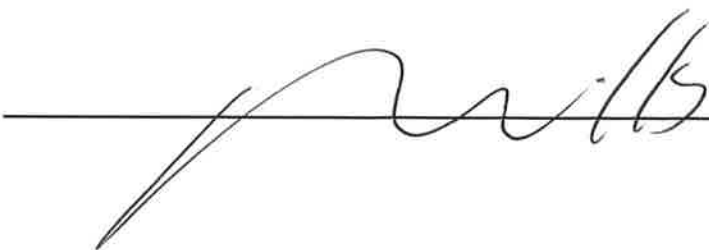
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REVIEWED BY:



DATE:

11/4/19

# NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS: Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850			
NEB PROJECT NUMBER: 05.0044476.00		NEB TEST NUMBER: 19-1448	COC # C39-3714/15
TEST ORGANISM: <i>Ceriodaphnia dubia</i>		AGE: <24 hours	Lot # Cd19(RMH 223)
START DATE: 10/8/19	TIME: 1355	END DATE: 10/15/19	TIME: 1448

Effluent Concentration	Culture Lot# Cd19(RMH 223)											Total Live Young	# Live Adults	Analyst- Transfer	Analyst- Counts
	Cup #	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11				
	Day Number	Replicate													
		A	B	C	D	E	F	G	H	I	J				
NEB Lab Synthetic Diluent	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CW	
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	PD	
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CH	
	3	5	✓	✓	✓	✓	✓	✓	✓	4	✓	9	10	PD	PD
	4	1	6	5	5	5	5	6	4	5	3	45	10	PD	PD
	5	7	7	8	7	9	9	10	5	5	6	73	10	KO	KO
	6	9	9	8	7	8	10	✓	3/x	✓	✓	54	9	CH	CH
	7	✓/x	6	✓	✓	✓	✓	10	X	9	11	36	8	PD	PD
	totals	22	28	21	19	22	24	26	12	23	20	217	8		MC
Merrimack River Control		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	6	6	6	4	6	5	7	6	5	5	56	10		
	5	6	9	8	7	8	7	10	10	7	1/x	73	9		
	6	9	11	9	✓	✓	✓	✓	✓	✓	X	29	9		
	7	✓	✓	✓	10	13	12	14	8	12	X	69	9		
	totals	21	26	23	21	27	24	31	24	24	6	227	9		
6.25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	4	4	1	5	6	5	6	6	5	5	47	10		
	5	9	10	7	8	6	6	11	8	8	6	79	10		
	6	2	7	9	11	8	✓	✓	9	8	10	64	10		
	7	✓	✓	8	✓	✓	10	12	✓	✓	✓	30	10		
	totals	15	21	25	24	20	21	29	23	21	21	220	10		

Notes: \_\_\_\_\_

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\_\_\_\_\_

**NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET**

FACILITY NAME & ADDRESS:		Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850			
NEB PROJECT NUMBER:	05.0044476.00	ORGANISM:	<i>Ceriodaphnia dubia</i>	START DATE:	10/8/19

Effluent Concentration	Day Number	Replicate										Total Live Young	# Live Adults		
		A	B	C	D	E	F	G	H	I	J				
12.5%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	✓	5	4	4	5	5	6	4	6	2	41	10		
	5	8	5	8	6	2	8	6	2	3	3	51	10		
	6	9	7	9	4	9	1	✓	11	8	7	65	10		
	7	✓	✓	✓	✓	✓	✓/x	11	✓/x	2	✓	13	8		
	<b>totals</b>	17	17	21	14	16	14	23	17	19	12	170	8		
25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	5	3	4	4	3	5	6	5	6	4	45	10		
	5	✓	4	4	9	5	6	6	7	3	6	50	10		
	6	5	✓	✓	6	9	✓	✓	✓	8	1	29	10		
	7	✓	8	6	✓	✓	9	4	7	✓	9	43	10		
	<b>totals</b>	10	15	14	19	17	20	16	19	17	20	167	10		
50%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	4	4	3	5	5	5	✓	4	4	4	38	10		
	5	4	3	4	2	4	6	✓	6	3	5	37	10		
	6	✓	✓	✓	5	✓	✓	✓	✓	✓	1	6	10		
	7	4/x	6	✓	✓	6/x	8	✓	3	4	4	35	8		
	<b>totals</b>	12	13	7	12	15	19	0	13	11	14	116	8		
100%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	4	6	5	6	5	6	4	5	✓	6	47	10		
	5	1	2	✓	2	✓	✓	✓	3	4	✓	12	10		
	6	✓	✓	✓	✓	✓	✓/x	✓/x	✓	✓	✓	0	8		
	7	2	✓	1	2	2	X	X	✓	✓	✓	7	8		
	<b>totals</b>	7	8	6	10	7	6	4	8	4	6	66	8		

# CETIS Analytical Report

Report Date: 16 Oct-19 11:38 (p 1 of 6)  
Test Code/ID: 19-1448 / 05-5255-8871

Ceriodaphnia 7-d Survival and Reproduction Test					New England Bioassay	
Analysis ID:	12-5620-5986	Endpoint:	2d Survival Rate	CETIS Version:	CETISv1.9.4	
Analyzed:	16 Oct-19 11:37	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1	
Batch ID:	00-2573-6666	Test Type:	Reproduction-Survival (7d)	Analyst:		
Start Date:	08 Oct-19 13:55	Protocol:	EPA/821/R-02-013 (2002)	Diluent:	Laboratory Water	
Ending Date:	15 Oct-19 14:48	Species:	Ceriodaphnia dubia	Brine:	Not Applicable	
Test Length:	7d 1h	Taxon:	Branchiopoda	Source:	In-House Culture	Age: <24
Sample ID:	20-3790-6911	Code:	7977FDDF	Project:		
Sample Date:	07 Oct-19 07:00	Material:	WWTF Effluent	Source:	Lowell RWWU (MA0100633)	
Receipt Date:	08 Oct-19 08:20	CAS (PC):		Station:		
Sample Age:	31h	Client:	New England Testing Labs			

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	1416448	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

2d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	D	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

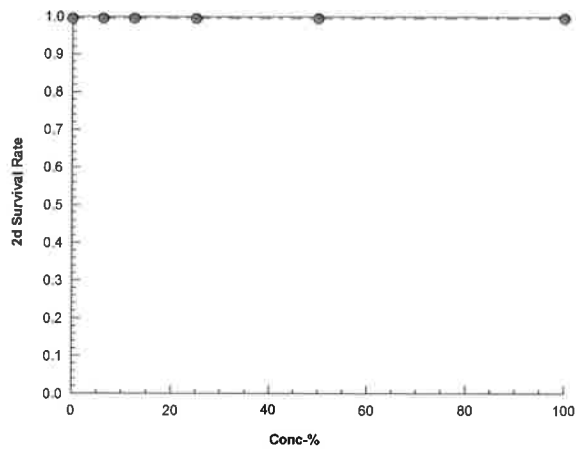
## 2d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID:	12-5620-5986	Endpoint:	2d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	16 Oct-19 11:37	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1

Graphics



# CETIS Analytical Report

Report Date: 16 Oct-19 11:38 (p 3 of 6)  
Test Code/ID: 19-1448 / 05-5255-8871

Ceriodaphnia 7-d Survival and Reproduction Test					New England Bioassay	
Analysis ID:	03-2907-0606	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4	
Analyzed:	16 Oct-19 11:37	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1	
Batch ID:	00-2573-6666	Test Type:	Reproduction-Survival (7d)	Analyst:		
Start Date:	08 Oct-19 13:55	Protocol:	EPA/821/R-02-013 (2002)	Diluent:	Laboratory Water	
Ending Date:	15 Oct-19 14:48	Species:	Ceriodaphnia dubia	Brine:	Not Applicable	
Test Length:	7d 1h	Taxon:	Branchiopoda	Source:	In-House Culture	Age: <24
Sample ID:	20-3790-6911	Code:	7977FDDF	Project:		
Sample Date:	07 Oct-19 07:00	Material:	WWTF Effluent	Source:	Lowell RWWU (MA0100633)	
Receipt Date:	08 Oct-19 08:20	CAS (PC):		Station:		
Sample Age:	31h	Client:	New England Testing Labs			

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	447676	200	Yes	Two-Point Interpolation

Test Acceptability Criteria		TAC Limits			
Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	0.8	0.8	>>	Yes	Passes Criteria

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

7d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	D	10	0.8000	0.0000	1.0000	0.4216	52.70%	0.0%	8/10	0.9	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	-25.0%	10/10	0.9	0.0%
12.5		10	0.8000	0.0000	1.0000	0.4216	52.70%	0.0%	8/10	0.9	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	-25.0%	10/10	0.9	0.0%
50		10	0.8000	0.0000	1.0000	0.4216	52.70%	0.0%	8/10	0.8	11.11%
100		10	0.8000	0.0000	1.0000	0.4216	52.70%	0.0%	8/10	0.8	11.11%

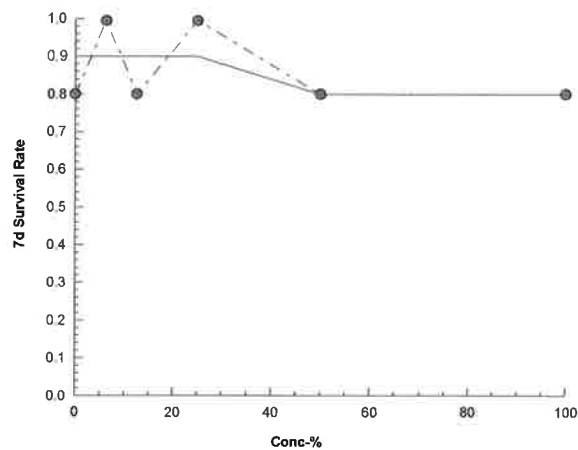
7d Survival Rate Detail											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		0.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	1.0000

7d Survival Rate Binomials											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1



Ceriodaphnia 7-d Survival and Reproduction Test			New England Bioassay
Analysis ID: 03-2907-0606	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4	
Analyzed: 16 Oct-19 11:37	Analysis: Linear Interpolation (ICPIN)	Status Level: 1	

Graphics



## CETIS Analytical Report

Report Date: 16 Oct-19 11:38 (p 5 of 6)

Test Code/ID: 19-1448 / 05-5255-8871

## Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

<b>Analysis ID:</b> 17-3205-4808	<b>Endpoint:</b> Reproduction	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 16 Oct-19 11:38	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Batch ID:</b> 00-2573-6666	<b>Test Type:</b> Reproduction-Survival (7d)	<b>Analyst:</b>
<b>Start Date:</b> 08 Oct-19 13:55	<b>Protocol:</b> EPA/821/R-02-013 (2002)	<b>Diluent:</b> Laboratory Water
<b>Ending Date:</b> 15 Oct-19 14:48	<b>Species:</b> Ceriodaphnia dubia	<b>Brine:</b> Not Applicable
<b>Test Length:</b> 7d 1h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In-House Culture <b>Age:</b> <24
<b>Sample ID:</b> 20-3790-6911	<b>Code:</b> 7977FDDEF	<b>Project:</b>
<b>Sample Date:</b> 07 Oct-19 07:00	<b>Material:</b> WWTF Effluent	<b>Source:</b> Lowell RWWU (MA0100633)
<b>Receipt Date:</b> 08 Oct-19 08:20	<b>CAS (PC):</b>	<b>Station:</b>
<b>Sample Age:</b> 31h	<b>Client:</b> New England Testing Labs	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	966482	200	Yes	Two-Point Interpolation

## Test Acceptability Criteria

## TAC Limits

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	21.7	15	>>	Yes	Passes Criteria

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	26.53	11.13	34.81	3.769	2.873	8.984
IC50	56.75	40.83	72.47	1.762	1.38	2.449

## Reproduction Summary

## Calculated Variate

## Isotonic Variate

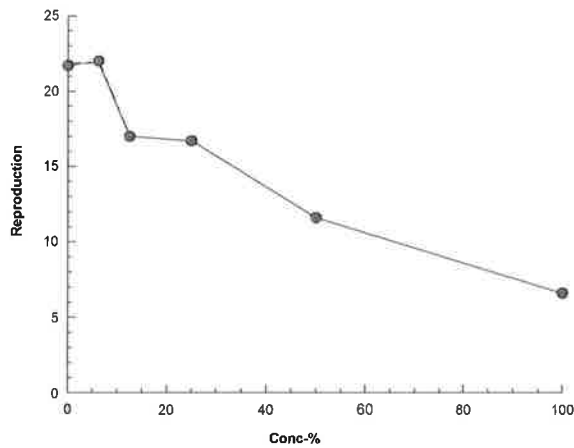
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	D	10	21.7	12	28	4.347	20.03%	0.0%	21.85	0.0%
6.25		10	22	15	29	3.651	16.60%	-1.38%	21.85	0.0%
12.5		10	17	12	23	3.333	19.61%	21.66%	17	22.2%
25		10	16.7	10	20	3.129	18.73%	23.04%	16.7	23.57%
50		10	11.6	0	19	5.082	43.81%	46.54%	11.6	46.91%
100		10	6.6	4	10	1.838	27.85%	69.59%	6.6	69.79%

## Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	22	28	21	19	22	24	26	12	23	20
6.25		15	21	25	24	20	21	29	23	21	21
12.5		17	17	21	14	16	14	23	17	19	12
25		10	15	14	19	17	20	16	19	17	20
50		12	13	7	12	15	19	0	13	11	14
100		7	8	6	10	7	6	4	8	4	6

Ceriodaphnia 7-d Survival and Reproduction Test			New England Bioassay
Analysis ID: 17-3205-4808	Endpoint: Reproduction	CETIS Version: CETISv1.9.4	
Analyzed: 16 Oct-19 11:38	Analysis: Linear Interpolation (ICPIN)	Status Level: 1	

Graphics



# CETIS Analytical Report

Report Date: 16 Oct-19 11:38 (p 1 of 2)  
Test Code/ID: 19-1448 / 05-5255-8871

## Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 20-4140-6329	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 16 Oct-19 11:37	Analysis: STP 2xK Contingency Tables	Status Level: 1
Batch ID: 00-2573-6666	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 08 Oct-19 13:55	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 15 Oct-19 14:48	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 7d 1h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 20-3790-6911	Code: 7977FDDF	Project:
Sample Date: 07 Oct-19 07:00	Material: WWTF Effluent	Source: Lowell RWWU (MA0100633)
Receipt Date: 08 Oct-19 08:20	CAS (PC):	Station:
Sample Age: 31h	Client: New England Testing Labs	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	>100	n/a	1

## Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	1.0000	Exact	1.0000	Non-Significant Effect
		12.5	0.7090	Exact	1.0000	Non-Significant Effect
		25	1.0000	Exact	1.0000	Non-Significant Effect
		50	0.7090	Exact	1.0000	Non-Significant Effect
		100	0.7090	Exact	1.0000	Non-Significant Effect

## Test Acceptability Criteria

		TAC Limits		Overlap	Decision
Attribute	Test Stat	Lower	Upper		
Control Resp	0.8	0.8	>>	Yes	Passes Criteria

## Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	D	8	2	10	0.8	0.2	0.0%
6.25		10	0	10	1	0	-25.0%
12.5		8	2	10	0.8	0.2	0.0%
25		10	0	10	1	0	-25.0%
50		8	2	10	0.8	0.2	0.0%
100		8	2	10	0.8	0.2	0.0%

## 7d Survival Rate Detail

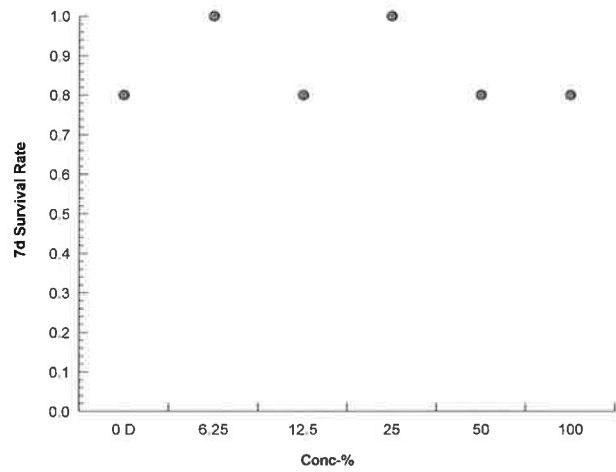
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		0.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	1.0000

## 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	0/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	0/1	1/1	0/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		0/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	0/1	0/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test			New England Bioassay
Analysis ID: 20-4140-6329	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4	
Analyzed: 16 Oct-19 11:37	Analysis: STP 2xK Contingency Tables	Status Level: 1	

Graphics



# CETIS Analytical Report

Report Date: 16 Oct-19 11:38 (p 1 of 2)  
Test Code/ID: 19-1448 / 05-5255-8871

## Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID: 08-4538-9939	Endpoint: Reproduction	CETIS Version: CETISv1.9.4
Analyzed: 16 Oct-19 11:38	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 00-2573-6666	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 08 Oct-19 13:55	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 15 Oct-19 14:48	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 7d 1h	Taxon: Branchiopoda	Source: In-House Culture <span style="float: right;">Age: &lt;24</span>
Sample ID: 20-3790-6911	Code: 7977FDDF	Project:
Sample Date: 07 Oct-19 07:00	Material: WWTF Effluent	Source: Lowell RWWU (MA0100633)
Receipt Date: 08 Oct-19 08:20	CAS (PC):	Station:
Sample Age: 31h	Client: New England Testing Labs	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	6.25	12.5	8.839	16	17.48%

### Dunnett Multiple Comparison Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	-0.1811	2.289	3.792	18	CDF	0.8816	Non-Significant Effect
		12.5*	2.837	2.289	3.792	18	CDF	0.0135	Significant Effect
		25*	3.018	2.289	3.792	18	CDF	0.0084	Significant Effect
		50*	6.097	2.289	3.792	18	CDF	1.2E-06	Significant Effect
		100*	9.115	2.289	3.792	18	CDF	9.4E-07	Significant Effect

### Test Acceptability Criteria

		TAC Limits			
Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	21.7	15	>>	Yes	Passes Criteria
PMSD	0.1748	0.13	0.47	Yes	Passes Criteria

### ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1776.73	355.347	5	25.9	<1.0E-37	Significant Effect
Error	741	13.7222	54			
Total	2517.73		59			

### Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	8.86	15.09	0.1148	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9484	0.9459	0.0131	Normal Distribution

### Reproduction Summary

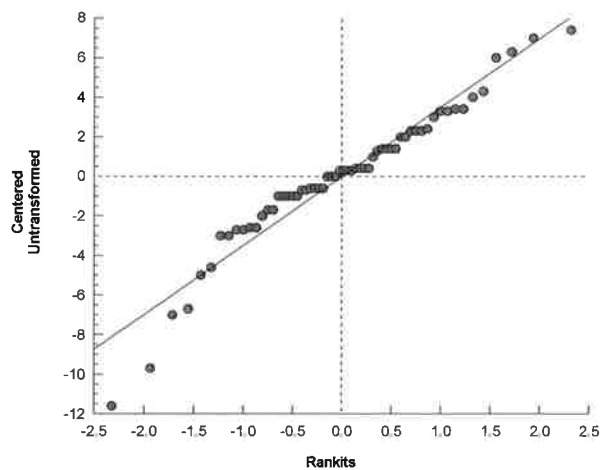
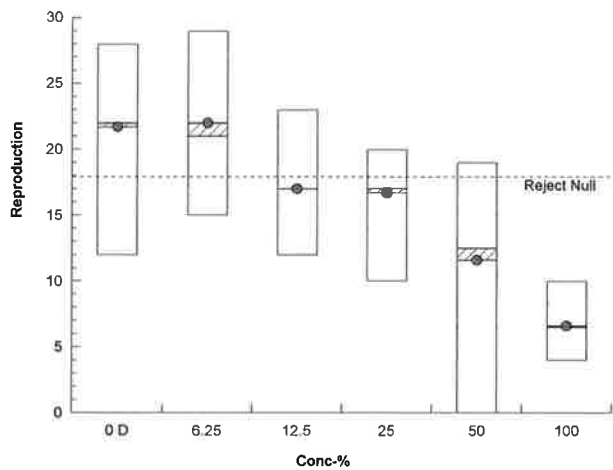
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	10	21.7	18.59	24.81	22	12	28	1.375	20.03%	0.00%
6.25		10	22	19.39	24.61	21	15	29	1.155	16.60%	-1.38%
12.5		10	17	14.62	19.38	17	12	23	1.054	19.61%	21.66%
25		10	16.7	14.46	18.94	17	10	20	0.9894	18.73%	23.04%
50		10	11.6	7.965	15.24	12.5	0	19	1.607	43.81%	46.54%
100		10	6.6	5.285	7.915	6.5	4	10	0.5812	27.85%	69.59%

### Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	22	28	21	19	22	24	26	12	23	20
6.25		15	21	25	24	20	21	29	23	21	21
12.5		17	17	21	14	16	14	23	17	19	12
25		10	15	14	19	17	20	16	19	17	20
50		12	13	7	12	15	19	0	13	11	14
100		7	8	6	10	7	6	4	8	4	6

Ceriodaphnia 7-d Survival and Reproduction Test			New England Bioassay
Analysis ID: 08-4538-9939	Endpoint: Reproduction	CETIS Version: CETISv1.9.4	
Analyzed: 16 Oct-19 11:38	Analysis: Parametric-Control vs Treatments	Status Level: 1	

Graphics



# NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:		Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850						
NEB PROJECT NUMBER:		05.0044476.00		TEST ORGANISM		Ceriodaphnia dubia		
DILUTION WATER SOURCE:		Laboratory Soft Water		START DATE:		10/8/19		TIME: 1355
ANALYST	CW	CW	CH	PD	PD	KO	CH	
NEB Lab Diluent	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.3	25.3	24.3	24.9	24.4	24.5	24.6	
D.O. mg/L Initial	8.2	8.4	8.4	8.3	8.3	8.4	8.2	
pH s.u. Initial	7.4	7.5	7.8	7.9	8.0	7.5	8.0	
Conductivity µS Initial	183	184	194	177	183	177	194	
Temp °C Final	24.0	24.5	24.8	24.2	24.3	24.1	24.1	
D.O. mg/L Final	8.5	8.3	8.5	8.4	8.3	8.2	8.4	
pH s.u. Final	7.2	7.9	7.5	7.8	8.1	7.8	7.9	
Conductivity µS Final	196	192	189	182	189	192	205	
Merrimack River Control	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.4	25.3	24.5	24.4	24.4	24.8	24.6	
D.O. mg/L Initial	8.9	8.4	9.7	9.3	8.7	8.4	8.8	
pH s.u. Initial	7.1	7.5	7.6	7.7	7.9	7.5	7.9	
Conductivity µS Initial	230	233	240	240	243	242	242	
Temp °C Final	24.0	24.5	24.7	24.2	24.3	24.1	24.0	
D.O. mg/L Final	8.4	8.2	8.4	8.4	8.2	8.2	8.4	
pH s.u. Final	7.2	7.9	7.5	7.9	7.9	7.7	7.7	
Conductivity µS Final	242	241	249	256	251	252	252	
6.25%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.5	25.0	24.6	25.0	24.4	24.6	24.7	
D.O. mg/L Initial	9.0	9.0	8.5	8.5	8.5	8.4	8.3	
pH s.u. Initial	7.0	7.5	7.6	7.7	7.8	7.5	7.9	
Conductivity µS Initial	228	226	204	208	222	227	224	
Temp °C Final	24.0	24.4	24.8	24.2	24.3	24.0	24.0	
D.O. mg/L Final	8.4	8.3	8.4	8.4	8.2	8.3	8.3	
pH s.u. Final	7.2	7.8	7.6	7.7	7.8	7.7	7.6	
Conductivity µS Final	239	232	213	213	229	237	234	
12.5%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.2	25.4	24.6	25.1	24.4	24.5	24.7	
D.O. mg/L Initial	8.4	8.5	8.5	8.4	8.4	8.3	8.3	
pH s.u. Initial	7.1	7.5	7.5	7.6	7.8	7.6	7.8	
Conductivity µS Initial	271	270	234	232	271	287	263	
Temp °C Final	24.0	24.4	24.9	24.2	24.3	24.0	24.0	
D.O. mg/L Final	8.5	8.3	8.5	8.4	8.3	8.3	8.4	
pH s.u. Final	7.2	7.8	7.7	7.7	7.9	7.6	7.6	
Conductivity µS Final	283	276	246	241	279	295	274	



## NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

[illegible]

Brood mother source: RMH 217 34 Source's brood size: 16 (Qty.)

Lowell 10-8-19

Tech	At	At	At	At	At	At	At	KF		KF		KF	At	KF		
Date	9-26	9-27	9-28	9-29	9-30	10-1	10-2	10-3		10-4		10-6	10-7	10-8		
Day acc.	0	1	2	3	4	5	6	7		8	9	10	11	12	13	14
Cup #																
1	N	N	N	N	5	7	4	N	1	Y		Y	Y	Y		
2	N	N	N	N	5	6	4	N	2	P		Y	Y <sub>17</sub>	Y <sub>15</sub>		
3	N	N	N	N	6	7	4	N	3	Y		Y	Y <sub>15</sub>	Y <sub>14</sub>		
4	N	N	N	N	5	8	4	N	4	P		Y	Y <sub>15</sub>	Y <sub>15</sub>		
5	N	N	N	N	5	7	4	N	5	Y		Y	Y <sub>16</sub>	Y <sub>14</sub>		
6	N	N	N	N	6	7	4	N	6	P		Y	Y <sub>17</sub>	Y <sub>15</sub>		
7	N	N	N	N	5	8	4	N	7	Y		Y	Y <sub>15</sub>	Y <sub>14</sub>		
8	N	N	N	N	5	7	4	N	8	Y		Y	Y <sub>15</sub>	Y <sub>11</sub>		
9	N	N	N	N	6	12	4	N	9	Y		Y	Y <sub>15</sub>	Y <sub>14</sub>		
10	N	N	N	N	3	7	4	N	10	Y		Y	Y	Y <sub>15</sub>		
11	N	N	N	N	4	8	4	N	11	Y		Y	Y <sub>15</sub>	Y <sub>15</sub>		
12	N	N	N	N	4	8	4	N	12	Y		Y	Y <sub>18</sub>	Y		
13	N	N	N	N	6	9	4	N	13	Y		Y	Y <sub>16</sub>	Y		

Y = neonates present, and criterion has been met: ≥ 20 neonates produced in total by 3rd brood.

N = no neonates

2B = two broods present. 2Y = two broods and criterion met: ≥ 20 neos. by 3rd brood.

X = brood mother dead ae = aborted eggs

✓ or P = neonates present after renewal on previous day (see time in log).

A→ = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted).

acc. = if acclimated, H<sub>2</sub>O type used w/ renewal this day.

## Test organism collection:

Tray diagram  
used?

Project #	Symbols (✓ / P)	(Y/N)	Time period, neonates released	Collection date / time
00441654	T	Y	10-6-19/1630 → 10-6-19/1825	10-7-19/1225
0044158	Ⓟ	Y	10-6-19/1630 → 10-6-19/1825	10-7-19/1250
0044476	T	Y	10-7-19/1630 → 10-7-19/1945	10-8-19/1300
	T			
	T			
	T			

## Table of Random Permutations of 16

## C.dubia Test ID#

## 19-1448

7	12	15	15	1	2	7	16	10	2	14	15	7	13	13	10	6	1	8	10
13	3	8	16	7	10	11	10	13	5	11	7	13	16	7	7	5	13	2	14
3	1	4	5	14	13	3	14	9	13	13	2	9	15	6	2	8	4	5	8
11	8	16	14	15	6	2	6	2	16	8	5	12	3	9	13	4	3	10	4
14	9	1	6	3	9	14	13	8	6	5	8	14	7	3	15	13	11	4	7
2	16	10	13	5	5	13	2	11	7	3	12	5	14	12	16	2	2	9	15
4	6	13	7	2	15	1	9	1	4	7	10	6	9	11	9	7	6	16	11
6	14	6	10	4	14	4	15	3	3	4	16	2	6	5	1	12	10	6	9
10	15	2	1	13	12	16	3	4	8	10	1	15	5	14	12	14	12	3	2
12	10	7	12	9	11	9	8	12	14	15	4	11	8	16	8	9	14	14	1
15	7	5	2	10	7	8	12	6	15	6	13	16	12	15	4	11	8	12	6
16	2	11	8	8	8	15	5	16	1	1	9	8	1	8	14	16	5	13	5
9	13	14	3	6	4	10	11	5	12	9	3	10	4	4	3	10	9	1	3
8	11	9	4	11	3	12	7	7	10	12	14	3	10	1	6	15	16	15	12
1	5	12	11	16	16	5	4	14	9	16	11	1	2	10	5	1	15	7	13
5	4	3	9	12	1	6	1	15	11	2	6	4	11	2	11	3	7	11	16
11	8	16	5	5	13	1	13	2	16	14	12	9	8	7	5	13	3	13	3
2	2	8	8	14	16	4	3	8	11	10	14	15	1	2	11	4	5	15	9
6	13	2	13	6	5	9	15	11	10	12	6	16	15	16	9	10	12	16	15
14	12	4	16	16	11	14	10	5	12	3	3	12	14	15	13	6	4	1	16
8	6	3	9	4	10	6	4	16	2	2	9	8	16	4	6	5	15	7	8
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3	10	11	12	13	12	5	11	7	8	9	5	14	11	10	1	3	13	3	5
16	1	13	14	8	14	15	5	3	7	11	15	6	12	5	7	11	1	14	4
1	14	14	2	9	15	16	14	6	14	7	8	3	13	11	8	7	7	12	7
4	4	6	4	12	3	11	8	15	9	8	1	13	6	3	3	15	9	9	12
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13	16	9	1	1	8	10	9	9	4	1	16	2	3	8	14	1	10	6	10
1	6	7	4	8	6	5	2	8	15	4	6	6	1	4	5	7	13	2	10
9	15	11	3	11	15	9	10	1	3	8	2	15	7	9	8	16	1	14	3
10	16	4	5	12	9	16	11	7	1	7	16	11	8	3	3	12	2	3	4
4	14	1	9	5	5	4	13	6	8	15	5	12	5	7	16	5	11	8	1
7	3	13	14	15	2	1	14	16	5	14	9	2	16	1	12	6	14	4	13
16	11	2	1	14	16	6	9	3	4	16	14	3	15	11	11	3	9	12	5
3	10	16	16	13	7	13	1	11	14	9	10	16	2	10	2	10	7	10	16
11	13	9	13	4	13	8	3	5	13	10	12	5	12	5	14	13	16	5	6
15	2	3	12	9	12	2	4	13	10	3	13	14	4	2	1	14	8	6	12
14	1	14	6	10	1	3	12	4	2	2	4	13	3	16	9	9	3	7	14
13	12	5	11	3	11	15	8	2	7	11	7	8	14	6	4	4	4	15	11
12	5	10	7	2	14	7	15	14	16	13	1	9	10	12	10	11	10	9	8
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2	7	6	2	1	8	10	6	15	12	1	11	7	11	13	6	1	15	13	15
6	4	15	8	16	10	14	16	9	6	12	3	10	6	14	7	2	12	16	7
5	8	12	15	7	3	12	5	12	9	5	15	1	13	15	13	15	5	1	2
13	4	10	4	16	13	16	13	5	3	6	14	1	16	8	7	2	3	3	12
5	14	4	6	8	2	15	1	13	14	16	4	15	4	3	12	12	1	4	7
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11	6	6	1	4	1	3	16	12	5	4	9	13	13	6	8	15	9	1	14
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8	13	13	3	3	10	13	2	4	1	8	6	11	14	15	6	9	16	2	2
16	16	5	12	11	6	1	3	8	16	3	7	2	5	16	14	13	7	14	15

# SAMPLE RECEIPT CHEMISTRY & CHAIN OF CUSTODY DOCUMENTS

# NEW ENGLAND BIOASSAY - INITIAL CHEMISTRY DATA

PERMITTEE: Lowell RWWU  
NEB JOB # 05.0044476.00

DATE RECEIVED	10/7/19		10/9/19		10/11/19	
SAMPLE TYPE:	EFF #1	RIVER #1	EFF #2	RIVER #2	EFF #3	RIVER #3
COC #	C39-3714	C39-3715	C39-3754	C39-3755	C39-3801	C39-3802
pH (SU)	6.9	6.9	7.3	7.3	6.9	6.8
Temperature (°C)	2.0	2.4	1.8	2.0	3.2	2.0
Dissolved Oxygen (mg/L)	10.3	10.7	12.5	12.4	11.0	10.3
Conductivity (µmhos)	886	233	638	240	937	245
Salinity (ppt)	<1	<1	<1	<1	< 1	< 1
TRC - DPD (mg/L)	0.074	0.035	0.009	0.035	0.015	0.019
TRC - Amperometric (mg/L)	<0.05	N/A	N/A	N/A	N/A	N/A
Hardness (mg/L as CaCO <sub>3</sub> )	76	28	60	32	74	32
Alkalinity (mg/l as CaCO <sub>3</sub> )	95	20	55	15	90	20
Tech Initials	CH	CH	KO	KO	CW	CW

NOTE: NA = NOT APPLICABLE

Data Reviewed By:



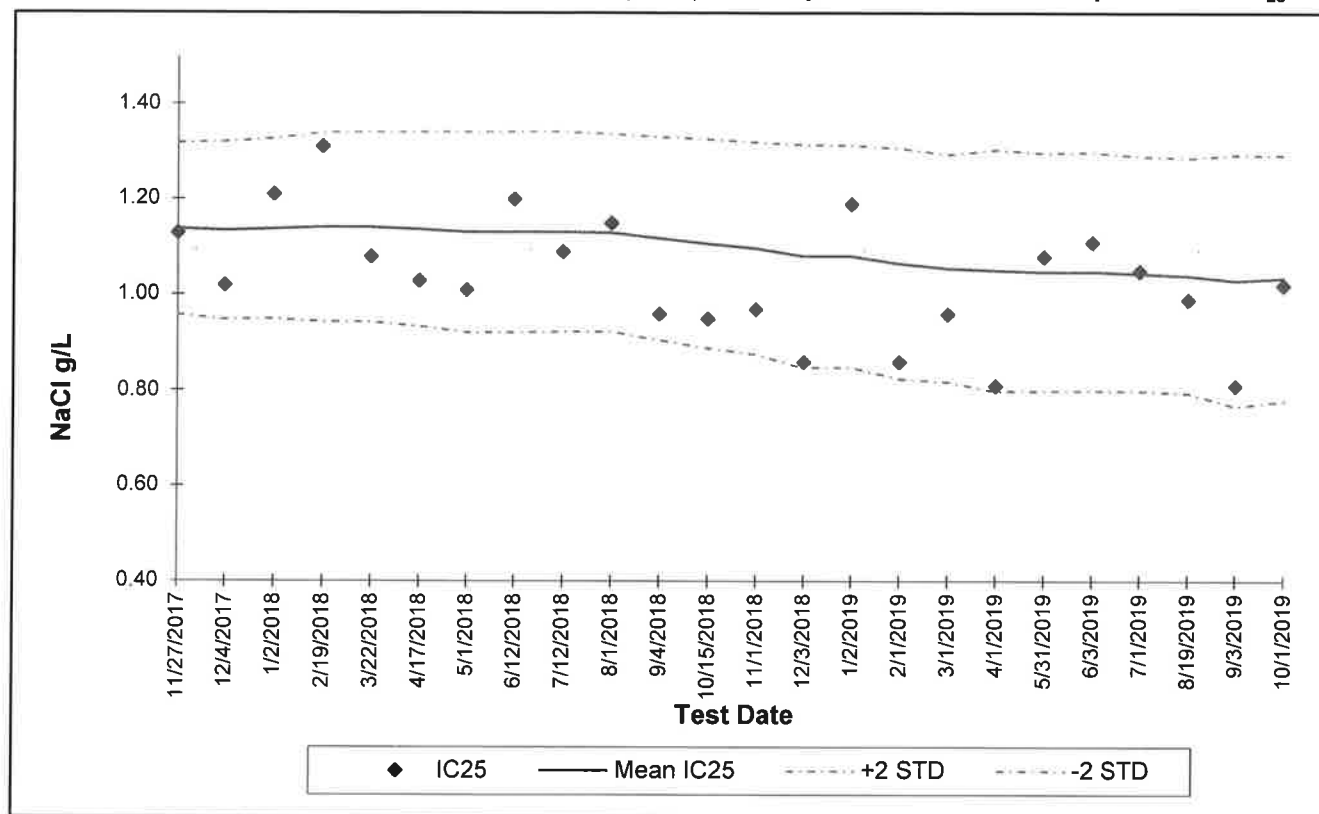
Date Reviewed:

11/4/19

# REFERENCE TOXICANT CHARTS

## New England Bioassay

Reference Toxicant Data: Sodium chloride (NaCl) *Ceriodaphnia dubia* Chronic Reproduction IC<sub>25</sub>



Test ID	Date	IC <sub>25</sub>	Mean IC <sub>25</sub>	STD	-2STD	+2STD	Avg. CV	Repro PMSD (%)	Avg. PMSD (%)
17-1787	11/27/2017	1.13	1.14	0.09	0.96	1.32	0.08	19.97	16.69
17-1846	12/4/2017	1.02	1.13	0.09	0.95	1.32	0.08	14.69	16.60
18-10	1/2/2018	1.21	1.14	0.09	0.95	1.33	0.08	10.81	16.36
18-271	2/19/2018	1.31	1.14	0.10	0.94	1.34	0.09	22.90	16.56
18-416	3/22/2018	1.08	1.14	0.10	0.94	1.34	0.09	17.59	16.88
18-553	4/17/2018	1.03	1.14	0.10	0.93	1.34	0.09	38.54	17.77
18-607	5/1/2018	1.01	1.13	0.10	0.92	1.34	0.09	24.65	18.25
18-816	6/12/2018	1.20	1.13	0.11	0.92	1.34	0.09	46.97	19.59
18-996	7/12/2018	1.09	1.13	0.10	0.92	1.34	0.09	11.41	19.70
18-1103	8/1/2018	1.15	1.13	0.10	0.92	1.34	0.09	17.23	19.67
18-1315	9/4/2018	0.96	1.12	0.11	0.91	1.33	0.10	22.12	20.09
18-1577	10/15/2018	0.95	1.11	0.11	0.89	1.33	0.10	24.32	20.64
18-1625	11/1/2018	0.97	1.10	0.11	0.88	1.32	0.10	31.57	21.34
18-1756	12/3/2018	0.86	1.08	0.12	0.85	1.32	0.11	15.77	21.00
19-8	1/2/2019	1.19	1.08	0.12	0.85	1.31	0.11	40.72	21.30
19-177	2/1/2019	0.86	1.07	0.12	0.82	1.31	0.11	18.71	21.63
19-265	3/1/2019	0.96	1.06	0.12	0.82	1.29	0.11	19.84	22.13
19-403	4/1/2019	0.81	1.05	0.13	0.80	1.30	0.12	10.09	21.85
19-674	5/31/2019	1.08	1.05	0.12	0.80	1.30	0.12	15.59	21.93
19-688	6/3/2019	1.11	1.05	0.12	0.80	1.30	0.12	15.24	22.23
19-926	7/1/2019	1.05	1.04	0.12	0.80	1.29	0.12	12.60	22.23
19-1154	8/19/2019	0.99	1.04	0.12	0.79	1.29	0.12	24.17	22.24
19-1226	9/3/2019	0.81	1.03	0.13	0.77	1.29	0.13	19.49	21.64
19-1396	10/1/2019	1.02	1.04	0.13	0.78	1.29	0.12	18.01	21.38

National 75th Percentile and 90th Percentile CV Averages for *Ceriodaphnia* Reproduction IC<sub>25</sub> (EPA 833-R-00-003): 0.45 - 0.62

PMDS Upper and Lower Bounds for *Ceriodaphnia* Reproduction (EPA-821-R-02-013): 13% - 47%

## Results:

**Sample: Effluent**  
**9J07023-01 (Water)**

### General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
<b>Alkalinity as CaCO<sub>3</sub></b>	<b>14</b>	2	mg/L	10/08/19
<b>Ammonia</b>	<b>17.1</b>	1.0	mg/L	10/11/19
<b>pH</b>	<b>7.2</b>	0.1	SU	10/07/19 17:20
<b>Specific Conductance</b>	<b>815</b>	2	uS/cm	10/08/19
<b>Total Dissolved Solids</b>	<b>376</b>	10	mg/L	10/09/19
<b>Total Organic Carbon</b>	<b>8.9</b>	0.2	mg/L	10/09/19
<b>Total solids (TS)</b>	<b>412</b>	10	mg/L	10/09/19
<b>Total Suspended Solids</b>	<b>6</b>	2	mg/L	10/09/19

### Total Metals

	Result	Reporting Limit	Units	Date Analyzed
<b>Calcium</b>	<b>21.1</b>	0.05	mg/L	10/09/19
<b>Magnesium</b>	<b>4.20</b>	0.05	mg/L	10/09/19
<b>Aluminum</b>	<b>0.030</b>	0.001	mg/l	10/08/19
Cadmium	ND	0.0001	mg/L	10/08/19
<b>Copper</b>	<b>0.007</b>	0.001	mg/l	10/08/19
<b>Nickel</b>	<b>0.003</b>	0.001	mg/l	10/08/19
<b>Lead</b>	<b>0.0005</b>	0.0001	mg/L	10/08/19
<b>Zinc</b>	<b>0.060</b>	0.001	mg/l	10/08/19
<b>Total Hardness</b>	<b>70.1</b>	0.125	mg/L	10/09/19

**Sample: Receiving Water**  
**9J07023-02 (Water)**

### General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
<b>Alkalinity as CaCO<sub>3</sub></b>	<b>14</b>	2	mg/L	10/09/19
<b>Ammonia</b>	<b>0.3</b>	0.1	mg/L	10/11/19
<b>pH</b>	<b>7.0</b>	0.1	SU	10/07/19 17:20
<b>Specific Conductance</b>	<b>211</b>	2	uS/cm	10/08/19
<b>Total Dissolved Solids</b>	<b>68</b>	10	mg/L	10/09/19
<b>Total Organic Carbon</b>	<b>2.8</b>	0.2	mg/L	10/09/19
<b>Total solids (TS)</b>	<b>92</b>	10	mg/L	10/09/19
Total Suspended Solids	ND	2	mg/L	10/09/19



**Sample: Receiving Water (Continued)**  
**9J07023-02 (Water)**

**Total Metals**

	Result	Reporting Limit	Units	Date Analyzed
<b>Calcium</b>	<b>8.21</b>	0.05	mg/L	10/09/19
<b>Magnesium</b>	<b>1.57</b>	0.05	mg/L	10/09/19
<b>Aluminum</b>	<b>0.025</b>	0.001	mg/l	10/08/19
Cadmium	ND	0.0001	mg/L	10/08/19
<b>Copper</b>	<b>0.001</b>	0.001	mg/l	10/08/19
Nickel	ND	0.001	mg/l	10/08/19
<b>Lead</b>	<b>0.0002</b>	0.0001	mg/L	10/08/19
<b>Zinc</b>	<b>0.006</b>	0.001	mg/l	10/08/19
<b>Total Hardness</b>	<b>27.0</b>	0.125	mg/L	10/09/19

# NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

## EFFLUENT

Sampler: JIN BOK MCGOWAN  
 Title: CHEMIST  
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Composite

Sample ID: \_\_\_\_\_  
 Start Date: 10-6-19 Time: 7:00  
 End Date: 10-7-19 Time: 7:00

Sampling Method: \_\_\_\_\_ Grab (for pH and TRC only \_\_\_\_\_)

Date Collected: \_\_\_\_\_  
 Time Collected: \_\_\_\_\_

Sample Type: \_\_\_\_\_ Prechlorinated  
                   X Dechlorinated  
                   \_\_\_\_\_ Unchlorinated  
                   \_\_\_\_\_ Chlorinated

## RECEIVING WATER

Sampler: ADAM FOX  
 Title: OPS. SUPERINT.  
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab

Sample ID: Merrimack River  
 Date Collected: 10-7-19  
 Time Collected: 8:30 AM

Received  
ON ICE

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

## Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: <u>[Signature]</u>	Date: <u>10-7-19</u>	Time: <u>11:15 AM</u>
Received By: <u>[Signature]</u>	Date: <u>10/7/19</u>	Time: <u>11:15</u>
Relinquished By: <u>[Signature]</u>	Date: <u>10/7/19</u>	Time: <u>16:15</u>
Received By: <u>[Signature]</u>	Date: <u>10/7/19</u>	Time: <u>4:05</u>
Relinquished By: <u>[Signature]</u>	Date: <u>10/7/19</u>	Time: <u>4:55</u>
Received By: <u>[Signature]</u>	Date: <u>10/8/19</u>	Time: <u>0800</u>

## FOR NEB USE ONLY

\* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory \*

Temperature of Effluent Upon Receipt at Lab: 2.0 °C  
 Effluent COC# C39-3714  
 Temperature of Receiving Water Upon Receipt at Lab: 2.4 °C  
 Receiving Water COC# C39-3715

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:  
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

# NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

## EFFLUENT

Sampler: JAN-BOK MCGOWAN  
 Title: CHEMIST  
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Composite

Sample ID: \_\_\_\_\_  
 Start Date: 10-8-19 Time: 7:00  
 End Date: 10-8-19 Time: 7:00

Sampling Method: \_\_\_\_\_ Grab (for pH and TRC only \_\_\_\_\_)

Date Collected: \_\_\_\_\_  
 Time Collected: \_\_\_\_\_

Sample Type: \_\_\_\_\_ Prechlorinated  
X Dechlorinated  
 \_\_\_\_\_ Unchlorinated  
 \_\_\_\_\_ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Received  
ON ICE

## Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: [Signature]  
 Received By: [Signature]  
 Relinquished By: [Signature]  
 Received By: [Signature]  
 Relinquished By: [Signature]  
 Received By: [Signature]

Date: 10-8-19 Time: 10:40  
 Date: 10-9-19 Time: 10:40  
 Date: 10-19-19 Time: 13:00  
 Date: 10-19-19 Time: 15:00  
 Date: 10-19-19 Time: 2:00  
 Date: 10-19-19 Time: 14:20

## FOR NEB USE ONLY

\* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory \*

Temperature of Effluent Upon Receipt at Lab: 1.8 °C

Temperature of Receiving Water Upon Receipt at Lab: 2.0 °C

Effluent COC# C39-3754

Receiving Water COC# C39-3755

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:  
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

# NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

## EFFLUENT

## RECEIVING WATER

Sample Set #3

Sampler: 51N B-K 1492  
 Title: CHEMIS  
 Facility: Lowell Regional Wastewater Utilities

Sampler: Agon Fox  
 Title: ops. superintendent  
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Composite

Sampling Method: X Grab

Sample ID: \_\_\_\_\_  
 Start Date: 10-10-19 Time: 7:00  
 End Date: 10-11-19 Time: 7:00

Sample ID: Merrimack River  
 Date Collected: 10-11-19  
 Time Collected: 7:45 AM

Sampling Method: \_\_\_\_\_ Grab (for pH and TRC only \_\_\_\_\_)

Date Collected: \_\_\_\_\_  
 Time Collected: \_\_\_\_\_

Received  
ON ICE

Sample Type: \_\_\_\_\_ Prechlorinated  
X Dechlorinated  
 \_\_\_\_\_ Unchlorinated  
 \_\_\_\_\_ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

## Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: <u>[Signature]</u>	Date: <u>10-11-19</u>	Time: <u>1020</u>
Received By: <u>[Signature]</u>	Date: <u>10/11/19</u>	Time: <u>1020</u>
Relinquished By: <u>[Signature]</u>	Date: <u>10/11/19</u>	Time: <u>1230</u>
Received By: <u>[Signature]</u>	Date: <u>10/11/19</u>	Time: <u>12:30</u>
Relinquished By: <u>[Signature]</u>	Date: <u>10/11/19</u>	Time: <u>1:20</u>
Received By: <u>[Signature]</u>	Date: <u>10/11/19</u>	Time: <u>1320</u>

## FOR NEB USE ONLY

\* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory \*

Temperature of Effluent Upon Receipt at Lab: 3.2 °C

Temperature of Receiving Water Upon Receipt at Lab: 2.0 °C

Effluent COC# C39-3801

Receiving Water COC# C39-3802

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:  
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042